

**Research, Engineering and Development Advisory Committee (REDAC)  
Holiday Inn Rosslyn Westpark Hotel  
1900 North Fort Meyer Drive, Arlington, VA  
Meeting Minutes**

**April 17-18, 2001**

On Tuesday and Wednesday, April 17-18, 2001, the Federal Aviation Administration (FAA) Research, Engineering and Development (R,E&D) Advisory Committee (REDAC) held a meeting at the Holiday Inn Rosslyn Westpark Hotel, 1900 North Fort Meyer Drive, Arlington, Virginia. Attachments 1 and 2 provide the meeting agenda and attendance, respectively.

**Tuesday, April 17**

**Welcome and Introductory Remarks**

Dr. Herman Rediess, Executive Director and Designated Federal Official of the Committee, welcomed members and audience participants and read the public meeting announcement.

Mr. Robert Doll, the out-going Chairman of the Committee, welcomed members and audience participants and announced the end of his term as REDAC Chairman, as he would be retiring off of the Committee after this meeting.

Dr. Rediess recognized retiring members for their contributions over the years. These included: Mr. Viggo Butler, Ms. Angela Gittens, Mr. Robert Doll, Mr. Paul Fiduccia, and Mr. Wilson Felder. Dr. Rediess welcomed new members Mr. David Ashley, Mr. John Klinkenberg, Mr. Richard Marchi, Mr. Ron Swanda (not in attendance), Dr. Hans Weber, and Dr. Andres Zellweger. Dr. Rediess announced the in-coming Chair Dr. Deborah Boehm-Davis.

Mr. Doll welcomed members of the AeroSpace Technology Advisory Group (ASTAC), an advisory committee similar to the FAA REDAC but under National Aeronautics and Space Administration (NASA). These members were attending the meeting as members of the Aerospace Transportation Advisory Group (ATAG), a joint REDAC and ASTAC subcommittee. The ASTAC members attending were Mr. Robert Spitzer, ATAG Co-Chair, Dr. George Donohue, and Mr. William Hoover.

**Remarks**

Mr. Steve Zaidman, FAA Associate Administrator for Research and Acquisitions, provided an update on current events at FAA. He discussed FAA's interaction with Congress, the President's budget, the performance-based organization (PBO), and a recent independent review of the Wide Area Augmentation System (WAAS).

FAA expects more rigorous oversight by Congress due to concern over delays, management accountability, and safety issues such as runway incursions. On March 15<sup>th</sup> Administrator Garvey provided testimony on delays before Chairman Harold Rogers and the House Appropriations Committee. She committed to six initiatives.

(1) Streamline the approval process for environmental issues. (2) Achieve consensus in the aviation community on the Operational Evolution Plan. (3) Issue capacity benchmarks for the top 31 airports. (4) Define “delay” as being late at the arrival gate by 15 minutes or more. (5) Continue activity under Free Flight Phase 1 and 2. (6) Eliminate system choke points or bottlenecks that are causing congestion, particularly in time for the summer season.

The President recently released the fiscal year (FY) 2002 budget. FAA’s budget has four parts. The facilities and equipment (F&E) budget is \$2.9 billion, a 10 percent increase over FY 2001. The Airport Improvement Program (AIP) budget is \$3.3 billion, a 3.5 percent increase over FY 2001. The R,E&D budget is \$188 million, a \$1 million increase over FY 2001. The operations budget is \$6.9 billion, a 5.7 percent increase over FY 2001. The operations budget, which is 75 percent salaries in addition to supplies and travel costs, continues to be FAA’s biggest concern.

Executive Order and the authorization legislation resulted in FAA establishing a performance-based organization (PBO) for the air traffic control system. The Chief Operating Officer for the PBO, who has not yet been named, will report directly to the Administrator. The PBO may submit its budget directly through the Secretary of Transportation to the President, who will transmit it without revision to the appropriate Congressional Committees. Legislation established two boards: the Aviation Management Advisory Council (MAC) and the Air Traffic Services (ATS) Subcommittee referred to as the “mini MAC”. The MAC consists of 18 members that represent aviation interests. It provides advice and counsel to the Administrator and functions as an oversight resource for the entire FAA organization with respect to management, policy, spending, and regulatory matters. The ATS Subcommittee or mini MAC falls under the MAC. It is a smaller group comprised of five executives from outside of the aviation industry and provides management oversight of the PBO similar to a board of directors. This includes review, approval and monitoring duties related to the budget, major acquisitions, management initiatives, and strategic and operational plans.

The five members selected for the ATS Subcommittee or mini MAC are as follows:

(1) Nancy Kassebaum Baker, former U.S. senator, who served as chairperson of the Senate Commerce Subcommittee on Aviation; (2) John J. Cullinane, president, The Cullinane Group, a computer software company; (3) Leon Lynch, international vice president for human affairs for the United Steelworkers of America; (4) Sharon Patrick, co-founder and president and COO of Martha Stewart Living Omnimedia, Inc.; and (5) John W. Snow, chairman, president, and CEO of CSX, a transportation company involved in rail, container shipping.

The Operational Evolution Plan (OEP) is a short-term (1-2 year), mid-term (3-4 year), and long-term (10 year) look into operational changes required for the future of the air

traffic control system. It is one of the foundations for the PBO requirement to create a business plan. The OEP contains 21 major action items focused on operational changes that will provide relief and improvement to the system. These include expanding the number of direct routes, reducing vertical separation over the U.S. and changing separation standards over oceans. The OEP is in the final stages of review, and it is available on the Web at <http://www.caasd.org>. FAA will distribute the latest draft to REDAC members.

Last year, FAA Administrator Jane Garvey requested that the Institute for Defense Analyses (IDA) conduct an independent review of the Wide Area Augmentation System (WAAS). The WAAS is an FAA program to augment the Department of Defense's (DoD) Global Positioning System (GPS). The IDA formed an *independent review board* (IRB) to accomplish the task. Dr. John Hansman, a REDAC member, served on the IRB. The group published its report on January 18, 2001. The report finds that although the program schedule has slipped in the past, the WAAS is technically feasible. It recommends that FAA identify a credible schedule as soon as possible and suggests a program completion date of early 2003. It identifies one weakness throughout the program in both the Government and contractor teams, and that is systems engineering. FAA has taken steps to strengthen systems engineering through the WAAS Integrity and Performance Panel. The IRB report is available on the Web at <http://gps.faa.gov>.

### **Meeting Process and Objectives**

Dr. Herman Rediess, FAA Director of Aviation Research, explained the meeting process and objectives. The primary objective of the meeting was to have the Committee generate recommendations on FAA's planned research and development (R&D) investments for FY 2003. Dr. Rediess would present FAA's planned R&D investment portfolio. Each standing subcommittee, having already reviewed FAA's respective R&D program, would present its recommendations. The six standing subcommittee areas are air traffic services, airport technology, aircraft safety, human factors, aviation security, and environment and energy. After the standing subcommittee presentations, the Committee would discuss issues and generate recommendations for the Administrator.

In addition to the standing subcommittee reports, the Committee would hear presentations by the Federal Transportation Advisory Group (FTAG) and three ad hoc subcommittees: Aerospace Transportation Advisory Group (ATAG), Small Aircraft Transportation System (SATS), and Tiltrotor and Advanced Rotorcraft Technology in the National Airspace System (TARTNAS).

### **Vision 2050: An Integrated Transportation System**

The National Science and Technology Council (NSTC) established the Federal Transportation Advisory Group (FTAG) in June 2000 under the auspices of the FAA REDAC and the NASA ASTAC. The objective of the FTAG was to develop a vision for the transportation system of the 21<sup>st</sup> century. The vision was to address the period of

time between the years 2020 and 2050 and include a series of “stretch goals” to guide future transportation research and development.

FTAG members represented aerospace, water, surface, and multi-modal transportation stakeholders. Members were from the National Academy of Science including the Transportation Research Board (TRB) and the Aeronautics and Space Engineering Board (ASEB) as well as Federal advisory committees including FAA REDAC, NASA ASTAC, and the U.S. Department of Transportation (DOT) Marine Transportation System National Advisory Council (MTSNAC).

Mr. Robert Spitzer, FTAG Chairman, presented the group’s report titled *Vision 2050: An Integrated National Transportation System*, which was completed in February. He planned to brief the NASA ASTAC on April 19-20 in Huntsville, Alabama. Vision 2050 argues for an integrated, multi-modal national transportation system that can economically move anyone and anything, anywhere, anytime, on time. In addition, the vision stresses a system without fatalities and injuries, not dependent on foreign energy, and compatible with the environment. The Vision 2050 document forms a framework under which each mode can generate a more detailed document on how to contribute to achieving the vision.

#### **Aerospace Vision (Ad hoc Subcommittee)**

At the April 12, 2000, joint meeting of the FAA REDAC and NASA ASTAC, both committees voted to approve a joint task force to guide the vision development process for the aviation system after next. Following the completion of the FTAG Vision 2050 report in February 2001, the REDAC chartered the Aerospace Transportation Advisory Group (ATAG) as an ad hoc subcommittee. The objective of the ATAG is to define an aerospace vision that fits under the framework of the FTAG Vision 2050 document and supports the nation’s transportation needs to mid-century. Dr. Andres Zellweger and Mr. Robert Spitzer co-chair the subcommittee.

Dr. Andres Zellweger presented the ATAG report. The report concludes that airlines, airports and FAA must undergo cultural and institutional changes involving radically new air transportation management concepts in order to achieve a modern, automated national air transportation system. It recommends that the Secretary of Transportation champion the modernization effort and charge the National Academy of Science with defining the aerospace vision and the research, technologies and concepts required to achieve it. Mr. Doll deferred the Committee’s vote on the report until the second day of the meeting.

#### **BREAK**

#### **Small Aircraft Transportation System (Ad hoc Subcommittee)**

On September 14, 1999, REDAC voted to approve a working group led by Mr. Paul Fiduccia to examine NASA’s Small Aircraft Transportation System (SATS) program and recommend whether REDAC should form an ad hoc subcommittee to study the program

in more depth. On April 12, 2000, during the joint meeting of the REDAC and NASA ASTAC, the committees voted to approve a joint SATS subcommittee chartered under the REDAC for a period of one year, through April 2001, with Mr. Fiduccia as chairman. The objective of the ad hoc subcommittee is to review and monitor the plans and activities of NASA, FAA, industry, and the National Research Council (NRC) with respect to SATS and report its findings to the REDAC and ASTAC.

Mr. Fiduccia presented the subcommittee's findings. SATSLab is a 5-year NASA program to demonstrate the SATS concept and technologies and conduct systems analyses and engineering. The subcommittee has concern over the complexity of the program organization and provided recommendations for both FAA and NASA. The Committee discussed the recommendations and agreed that Mr. Fiduccia should prepare a letter for the REDAC to transmit the recommendations to the Administrator.

Mr. Fiduccia explained an issue regarding the joint SATS subcommittee, which NASA surfaced due to concern over procedural differences between the REDAC and ASTAC. Mr. Terry Hertz, NASA Director, Research and Technology Division presented NASA's proposal to resolve the issue. It involved moving the SATS subcommittee from REDAC sponsorship to ASTAC sponsorship, and inviting REDAC members to participate on it. Mr. Fiduccia presented another alternative on behalf of the existing subcommittee. It involved allowing REDAC to continue the SATS subcommittee; then, the two SATS subcommittees (REDAC and ASTAC) could meet concurrently, and the subcommittee chairs could agree on a common agenda and report back to their respective advisory committee. Members were concerned that the charter proposed by NASA for the ASTAC subcommittee did not address issues important to FAA; therefore, it was important to continue the REDAC subcommittee to address these issues. The Committee voted to approve the continuation of the SATS subcommittee under the REDAC according to the proposal presented by Mr. Fiduccia.

## **LUNCH**

### **Terminal Area and Runway Safety R&D**

Mr. Archie Dillard, FAA Flight Standards Service National Research Specialist for Simulation Engineering (AFS-400) and Mr. Ken Leonard, FAA Deputy Product Lead for Safe Flight 21 and Surface Technology (AND-501), presented FAA's terminal area and runway safety research and development (R&D). Originally, FAA presented this briefing to the Aircraft Safety Subcommittee, who recommended that the full REDAC hear it.

### **FAA Response to Committee Recommendations**

Dr. Rediess presented a follow-up, interim response to the Committee's recommendations on FAA's planned R&D investments for FY 2002, which the Committee developed at the April 2000 meeting and presented to Administrator Garvey by letter dated July 13, 2000. Dr. Rediess' initial response at the September 2000 Committee meeting reflected FAA's budget prior to submitting it through the Executive

Branch. This response reflected FAA's budget as it appears in the President's budget for FY 2002, which was recently presented to Congress. Dr. Rediess plans a third presentation for the next Committee meeting on October 30-31 that will reflect the Congressional budget. A formal response from FAA will follow that presentation.

### **Presentation of FAA's R&D Investments for FY 2002 and FY 2003**

Dr. Rediess provided an overview of FAA's R&D investments including a review of the FY 2002 President's budget request and an in-depth review of FAA's proposed R&D investments for FY 2003.

### **Subcommittee Recommendations**

In February and March 2001, the six standing subcommittees reviewed FAA's six R&D investment areas including air traffic services; airport technology; aircraft safety; aviation security; human factors; and environment and energy. After reviewing the respective investment portfolio proposed by FAA, each subcommittee generated recommendations on the portfolio. Each standing subcommittee chair, as listed below presented these recommendations to the Committee. Attachment 3 provides the subcommittees' reports.

Subcommittee on Air Traffic Services	Mr. Paul Drouilhet
Subcommittee on Environment and Energy	Mr. James DeLong

### **Adjourn**

Mr. Doll adjourned the Committee meeting for the day at 5:30 p.m.

### **Wednesday, April 18**

#### **Reconvene Meeting**

Dr. Deborah Boehm-Davis, incoming Chair, welcomed members and attendees and reconvened the meeting at 9:00 a.m. on Wednesday, April 18. Dr. Rediess read the public meeting announcement.

#### **Tiltrotor & Advanced Rotorcraft Technology in the NAS (Ad hoc Subcommittee)**

The Subcommittee on Tiltrotor and Advance Rotorcraft Technology in the National Airspace System (TARTNAS) is an ad hoc subcommittee initiated on April 8, 1997, as the Subcommittee on General Aviation and Vertical Flight. On January 21, 1999, its terms of reference was extended for two years, and on April 12, 2000, the Committee approved the current name of the subcommittee with a revised terms of reference.

The objective of the subcommittee is to determine the research activities and criteria necessary to establish the means of exploiting the combination of Global Positioning

System (GPS), tiltrotor and advanced vertical flight technology to serve the air traveling public and air commerce and, in doing so, to address issues of safety, performance and technology. Mr. John Olcott and Mr. John Zugschwert co-chair the subcommittee.

Mr. John Zugschwert presented the subcommittee's report along with team leaders including Dr. John Everton, Mr. Chuck Stancel, and Mr. Ron Reber. The Committee provided feedback to the subcommittee and expressed concern that the majority of recommendations in the report did not address research. The Committee decided to defer voting on the report until a later date to allow the subcommittee time to generate additional information and recommendations on what research was required to implement TARTNAS.

### **Vote on ATAG Report**

The Committee voted to approve the ATAG report and cover letter. The Committee decided that Dr. Boehm-Davis, REDAC Chair, would prepare an additional cover letter on behalf of the REDAC to transmit the report to Administrator Jane Garvey and ask her to forward the report to Transportation Secretary Norman Mineta. Mr. Spitzer, ATAG Co-chair and member of the NASA ASTAC, would work to accomplish the same endorsement from the NASA ASTAC during its April 19-20 meeting in Huntsville, Alabama. The ASTAC would send its endorsement through NASA Administrator Dan Goldin.

### **Subcommittee Recommendations (Continued from Day 1)**

The standing subcommittee chairs continued their reports and recommendations on FAA's planned FY 2003 R&D investments. This was a continuation of the standing subcommittee presentations, which began on the previous afternoon. Attachment 3 provides the subcommittees' reports.

Subcommittee on Human Factors	Dr. Deborah Boehm-Davis (outgoing chair) Dr. John Hansman (incoming chair)
Subcommittee on Airport Technology	Ms. Angela Gittens
Subcommittee on Aircraft Safety	Dr. Lou Mancini
Subcommittee on Aviation Security	Mr. Viggo Butler

### **Committee Recommendations**

Dr. Boehm-Davis opened the floor to the Committee members to discuss recommendations on FAA's planned FY 2003 R&D investments. The Committee held discussions and generated recommendations, which Dr. Boehm-Davis provided on behalf of the Committee to the Administrator by letter dated July 10, 2001. The following paragraphs provide the recommendations.

The members of the R,E&D Advisory Committee represent a significant wealth of industry, university, association, and consumer knowledge and experience. I believe that,

because of the way that the Committee now operates, the FAA is not getting the full benefit of this knowledge and experience. First, it has been difficult to brief subcommittees at the appropriate level of detail and in a timely fashion. Thus, committees often feel that their input is not based on as much information as they would like and that they cannot provide the appropriate feedback on important, strategic level issues regarding research and development. Second, as we discussed, it is difficult for the Committee to deliberate in an open setting. Having some time available for a closed session is important to a full and open discussion of recommendations. Finally, the low attendance by associate administrators and other senior FAA officials at our meetings gives the impression that the FAA does not appear to be interested in receiving our advice and that research is not a very high priority for the FAA. I would like to explore with you ways of raising the level of presentation and discussion of the FAA's R,E,&D program (and budget) so that we can provide you with better and more useful recommendations.

The Committee supports continued work on the Operational Evolution Plan (OEP) and Operational Concepts Plan (OCP), which covers the next 10 to possibly 15 years. They provide a common framework for the entire aviation community and will guide investments for government, operators and manufacturers. However, we are concerned that no research plan has been developed to complement the OEP and to provide the technology base for the future. Since this research is likely to be done largely by NASA, it is imperative that NASA's program planning become tightly integrated with FAA planning.

We also are concerned that although the activities defined in the OEP and OCP are important first steps in alleviating the capacity crisis, they will not meet the demand for 2010 and beyond. We believe the incremental evolutionary steps outlined in these plans will not overcome gridlock by the years 2010 to 2015. With demand projected to increase at 8 percent per year, and capacity improvements expected at only 3 percent per year, demand will soon overcome capacity. The nation must invest more heavily in aviation research to meet future needs, and we would like to help you work with NASA to achieve this outcome.

We believe that a major paradigm shift, supported by a substantial research effort, is required to move us beyond the 2010 to 2015 timeframe. Year after year, we express our concern over the lack of investment in aviation related research, but we have been ineffective in achieving any results. At the same time, the committee recognizes a number of obstacles to ensuring a viable, healthy air transportation system beyond 2010, including:

- The lack of a national transportation policy and national objectives to be achieved;
- The lack of a sense of "urgency" on the part of Congress to address aviation issues, perhaps due in part to the fact that aviation is the safest mode of transportation in the world;



- The increasing reliance on NASA to help support the FAA RE&D mission, without a mechanism for ensuring closure of the technology readiness gap;
- The lack of OMB and Congressional support for an increased budget; and
- The lack of compelling stories to make an argument for the need for increased funding.

The Committee would hate to have a serious accident, incident, or system interruption as the driver for an increased RE&D budget. Rather, we would hope to work with you to secure increased funding to prevent future accidents. We feel that one possible approach to making this case might be to put forward specific goals to be achieved by a specific deadline. Recognizing that FAA and NASA both have the same Senate authorization committee, and that the NASA and FAA R,E&D budgets are both authorized by the same House committee, we would hope to go with you to ask for support so that FAA and NASA can work together to achieve these goals.

For example, the Committee feels that there are two achievable goals that would increase capacity if the research issues could be resolved -- reduced wake turbulence separation in appropriate weather conditions and implementation of low noise arrival and departure procedures. By specifying, for example, that separation could be reduced by some specified percentage by the year 2005, FAA could argue for increased funding while providing benchmarks to ensure that predicted outcomes are being achieved.

Another concern arises from the development of the PBO within FAA. Because the R,E&D Advisory Committee currently is aligned along the lines of business, we believe there may be a need to rethink its function and structure as a result of the PBO. We would like to provide recommendations to you on this as the PBO unfolds.

The Committee developed specific recommendations that could be acted on without changes in the RE&D budget. First, the Committee recommends that all FAA R,E&D programs be reviewed after they have been in place for a certain amount of time (e.g., 3 years) and/or after a certain amount of funds has been spent (e.g., \$1million). Further, the Committee recommends that an internal process be developed for carrying out those reviews.

The Committee expressed concern about some items in the RE&D portfolio that the Committee strongly feels belongs in the Operations portfolio. For example, the Human Factors Subcommittee feels that the bulk of the aeromedical work being conducted at CAMI (particularly in the areas of medical/toxicological factors) is directed towards the support of actual accident investigations, not at research that could improve safety by improving the accident investigation process. Similarly, the Air Traffic Services Subcommittee feels that the work being done on system capacity, planning, and improvements is not a focal point for FAA's more general work on capacity R&D.

Individual subcommittees recommended moving forward on specific research programs, which were supported by the full Committee. These include:

- Research examining wake vortex and aviation weather;
- Research examining whether new large aircraft (group 6) can operate at group 5 airports;
- Research to find a replacement for aqueous film forming foam (AFFF). This foam is the primary fire-fighting agent currently in use. However, this foam is now considered toxic and will no longer be manufactured. Thus, research is urgently needed (and is planned in conjunction with DOD) in this area;
- Research on wildlife control and mitigation;
- Research into visual guidance that can be used to prevent runway incursions; and
- Research on high payoff solutions (e.g., trace technologies and other passive devices) rather than active devices for aviation security.

### **Future Committee Activity**

Dr. Boehm-Davis announced a change for the fall REDAC meeting, which was originally scheduled in September. The next REDAC meeting would be October 30-31, 2001, and part of this October meeting would be conducted as a joint meeting with the NASA ASTAC. Dr. Boehm-Davis asked members to consider material for discussion with their NASA ASTAC counterparts. Dr. Rediess requested that the material be action-oriented.

### **Adjourn**

Dr. Boehm-Davis adjourned the meeting at 2:40 p.m.

**Research, Engineering & Development Advisory Committee (REDAC)**  
**Holiday Inn Rosslyn Westpark Hotel**  
**1900 North Fort Myer Drive, Arlington, VA**  
**(703) 807-2000 FAX: (703) 522-7480**

**April 17-18, 2001**

**AGENDA**

**Day 1 – April 17**

9:00 a.m. – 9:30 a.m.	Welcome and Introductory Remarks - Announcement of In-coming Chair - Farewell to Retiring Members (Viggo Butler, Angela Gittens Robert Doll, Paul Fiduccia, Wilson Felder) - Welcome New Members (David Ashley, John Klinkenberg, Richard Marchi, Ron Swanda, Hans Weber, Dres Zellweger)	Mr. Robert Doll, Chair Dr. Deborah Boehm-Davis, Chair Dr. Herman Rediess, FAA
9:30 a.m. – 9:45 a.m.	Remarks	Mr. Steve Zaidman, FAA
9:45 a.m. – 10:00 a.m.	Meeting Process and Objectives	Dr. Herman Rediess, FAA
10:05 a.m. – 10:45 a.m.	“Vision 2050: An Integrated Transportation System” -- Presentation of Report	Mr. Robert Spitzer, ASTAC
10:45 a.m. – 11:00 a.m.	BREAK	
11:00 a.m. – 11:40 a.m.	Aerospace Vision (Ad hoc Subcommittee) -- Status Report	Dr. Andres Zellweger Mr. Robert Spitzer
11:40 a.m. – 12:20 p.m.	Small Aircraft Transportation System (Ad hoc Subcommittee) – Status Report	Mr. Paul Fiduccia Mr. Terry Hertz, NASA Mr. Pete McHugh, FAA
12:20 p.m. – 1:30 p.m.	LUNCH	
1:30 p.m. – 2:15 p.m.	Terminal Area and Runway Safety R&D	Mr. Archie Dillard, FAA Mr. Dave Ford, FAA
2:15 p.m. – 2:45 p.m.	FAA Response to Committee Recommendations	Dr. Herman Rediess, FAA
2:45 p.m. – 3:15 p.m.	Presentation of FAA’s R&D Investments for FY 2002 and FY 2003	Dr. Herman Rediess, FAA
3:15 p.m. – 3:30 p.m.	BREAK	
<b>Subcommittee Recommendations</b>		
3:30 p.m. – 4:15 p.m.	Subcommittee on Air Traffic Services	Mr. Paul Drouilhet
4:15 p.m. – 5:00 p.m.	Subcommittee on Environment and Energy	Mr. James DeLong

5:00 p.m. Adjourn

**Day 2 – April 18**

8:00 a.m.	Reconvene Meeting	Mr. Robert Doll, Chair Dr. Deborah Boehm-Davis, Chair Dr. Herman Rediess, FAA
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8:05 a.m. – 8:45 a.m.	Tiltrotor & Advanced Rotorcraft Technology in the NAS (Ad hoc Subcommittee) – Presentation of Report	Mr. John Zugschwert
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**Subcommittee Recommendations (Continued from Day 1)**

8:45 a.m. – 9:30 a.m.	Subcommittee on Human Factors	Dr. Deborah Boehm-Davis
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9:30 a.m. – 10:15 a.m.	Subcommittee on Airports	Ms. Angela Gittens
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10:15 a.m. – 10:30 a.m.	BREAK	
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10:30 a.m. – 11:15 a.m.	Subcommittee on Aircraft Safety	Dr. Lou Mancini
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11:15 a.m. – 12 noon	Subcommittee on Security	Mr. Viggo Butler
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12:00 noon	LUNCH	
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1:00 p.m. – 2:45 p.m.	Committee Discussion on Recommendations	Mr. Robert Doll, Chair Dr. Deborah Boehm-Davis, Chair
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2:45 p.m. – 3:00 p.m.	Review Future Committee Activity	Mr. Robert Doll, Chair Dr. Deborah Boehm-Davis, Chair
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3:00 p.m.	Adjourn	
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**Research, Engineering and Development Advisory Committee (REDAC)****April 17-18, 2001****Attendance****REDAC Members**

Deborah Boehm-Davis, Chair	Robert Doll, Chair	David Ashley
Mike Benzakein	Viggo Butler	James DeLong
Paul Drouilhet	Chester Ekstrand	Wilson Felder
Paul Fiduccia	Angela Gittens	John Hansman
John Kern	John Klinkenberg	Louis Mancini
Richard Marchi	John O'Brien	Hans Weber
Andres Zellweger	Robert Pearce (for Sam Venneri)	
Herman Rediess (Executive Director)		

**ATAG Members**

Robert Spitzer, Co-chair	William Hoover	George Donohue
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**Audience**

Herb Bachner, FAA	Tony Freck, GE Aircraft	Mike Gallivan, FAA
Ken Knopp, FAA	Jerry Chambers, AA	Warren Fellner, FAA
Jim Poage, Volpe	Bill Edmunds, ALPA	Chuck Friesenhahn, FAA
Charles Huettner, OSTP	Andre Broom, GAMA	Greg Burke, FAA
Ken Cobb, TRW	Satish Agrawal, FAA	Sharon Darnell, FAA
Ed Feddeman, House Science Committee	Frank Alexander, Northwest Airlines	Geoff Mumford, American Psychological Association
Terry Hertz, NASA	Archie Dillard, FAA	Ken Leonard, FAA
James Rogers, FAA	Marshall Potter, FAA	Nick Stoer, Stoer Associates
Tom Proeschel, FAA	Chris Peterson, SRI	Roger Stern, Lockheed Martin
Bennie Sanford, FAA	Erwin Williams, AvMet	George Greene, FAA
George Marania, FAA	Rosanne Marion, FAA	Lee Olson, FAA
Chuck Larsen, FAA	Paul Murphy, SETA	Dennis Kershner, JHU/APL
Mike Perie, AT/CA	Roy Reichenbach, NASA	Keith Murray, MITRE
Tom McCloy, FAA	Vic Lebacqz, NASA ARC	Gloria Kulesa, FAA
Jim Washington, FAA	Paul Jones, FAA	Chris Seher, FAA
Dave Smith, FAA	Glenn Roberts, MITRE	Thomas Harman, Inside FAA
Nancy Lane, FAA	Quinten Johnson, FAA	Ed Schuman, FAA
Karen Stewart, FAA	Chuck Ruehle, FAA	Randy Stevens, FAA
Jim White, FAA	John Rekstad, FAA	Paul Polski, FAA
Mary Powers-King, FAA	Frank Petroski, MITRE	Steve Pansky, FAA
Richard Young, AvMet	George Chang	Barry Scott, FAA
Nan Shellabarger, FAA	Ron Reber, Bell Helicopter	Mike Webb, FAA
Bill Wallace, FAA	Jerry Wright, ALPA	Norm Mowbray, BHTI
John Zugschwert	Sandra Warren, BAE	Chuck Stancil, GA Tech.
June Lidder, BAE	Vergenia Embry-Brock	Marv Nuss, FAA
Kolie Lombard, FAA	Jan Brecht-Clark, FAA	J. Leverton, AHS International
Paul Murphy, SETA	Thomas O'Brien, FAA	Gloria Dunderman, CSSI, Inc.
Tom Hetrick, BAE	John Rybka, FAA	Latonia Swell, CSSI, Inc.

## **Recommendations on FAA's 2003 R&D Investments**

### ***Report from the Air Traffic Services Subcommittee***

Chairman: Mr. Paul Drouilhet

The ATSSC reviewed the proposed FAA ATS R&D program at its meeting on February 21-22, 2001. Table I (attachment 1) lists each R&D program with its current year (FY01) and proposed FY03 funding. (Proposed FY02 funding is not available until the President's budget is submitted to Congress.) The table includes both R,E&D-funded programs and F&E(Activity 1)-funded programs. Also shown are funding for related MITRE/CAASD and NASA programs.

### **PORTFOLIO CONTENT**

The ATSSC felt that all of the programs were important activities. However, some were viewed as not appropriate as R&D-funded efforts. This is discussed in greater detail below.

### **PARTNERSHIPS**

In ATS R&D, the FAA has partnerships with NASA, Eurocontrol, and academia (through NEXTOR).

The partnership with NASA is especially important, as NASA is doing or supporting almost all of the R&D on advanced ATS technologies and procedures, which is being done in the U.S. It is important that the FAA continue to play an active role in the formulation and guidance of the NASA programs so that the products of these efforts can be transitioned to the FAA for implementation.

The FAA has an effective R&D partnership with Eurocontrol, with joint activities being carried out in some areas (e.g. data link). However, with the increased role that the European Commission is playing in ATS R&D in Europe, the ATSSC recommends that the FAA interact more directly with the relevant EC offices.

The FAA also has an ATS R&D partnership with a consortium of universities through the NEXTOR program. The FAA established NEXTOR several years ago, but has made relatively little use of this partnership. NEXTOR has been funded at substantially less than the originally-stated intent. The ATSSC feels that the FAA could get substantially more benefit from this partnership with academia, but that more involvement and support by the FAA would be required.

### **PROCESS**

The current Advisory Committee structure is meeting the statutory requirement for an independent review of the FAA's R,E&D portfolio. However, because of the size and complexity of the portfolio, especially in the ATS area, the review is quite superficial. The ATSSC has suggested in the past that the FAA use it to carry out ad hoc in depth studies of

topics of special importance. The format of such studies could be a series of meetings over a several month time period, or a one-to-two week full time study. Two possible subjects for such studies are discussed below.

The current subcommittee structure is appropriate. However, with the currently ongoing reorganization of the FAA, involving the creation of a PBO responsible for all ATS-related activities, the reporting structure of the ATSSC should change accordingly. This is discussed in greater detail below.

## ADDITIONAL GUIDANCE AND RECOMMENDATIONS

### Role of ATSSC in a reorganized FAA

The FAA is currently creating a Performance-Based Organization (PBO), headed by a Chief Operating Officer (COO), to manage all aspects of Air Traffic Services. It is anticipated that the ATS research will fall within the responsibility of the COO/PBO. The ATSSC endorses this. However, the ATSSC is a subcommittee of the REDAC, which reports to the Administrator. It is expected that the REDAC will continue to make its recommendations to the Administrator, as it has oversight of the other FAA R&D activities (safety, security, airports, etc.) which are not within the PBO.

The function of the ATSSC will still be required in the new organization. However, to be effective it should be viewed by the PBO/COO as its advisory committee, not the Administrator's. **Therefore the ATSSC recommends that its de facto reporting chain be to the COO (perhaps through the MAC), while de jure it remains part of the REDAC to satisfy the statutory requirements.** (An alternative, of course, is to disestablish the ATSSC as a subcommittee of the REDAC, and create a new ATS R&D advisory committee for the COO. This is the "cleanest" approach, but may require legislation.)

### Budget structure

While essentially all the R&D programs elements briefed to the ATSSC are important activities, many of them appear miscategorized as R&D activities. Many address the application of existing technologies and procedures to provide near-term solutions of current operational problems, and would appear to be more appropriately part of the operational or F&E(2) budget lines.

This leads to a distorted view of the level of resources actually being devoted to R&D. As it has in the past, **the ATSSC recommends that the FAA adopt a more descriptive categorization of its ATS R&D activities, perhaps based on the five-category system (6.1 through 6.5) used by the Department of Defense (DoD).** The creation of the PBO provides an opportunity for the introduction of such a budget structure.

A related budget issue of concern to the ATSSC is the frequent lack of budgeting for follow-on, or P3I, activities. While the FAA has nominally adopted the "spiral development" paradigm, it seldom appears to budget for the post-initial-deployment stages of development. **The ATSSC**

**recommends that these costs be more explicitly recognized and planned for during program planning.**

**Recommendations on FAA's 2003 R&D Investments**

***Report from the Airports Subcommittee***

Chair: Ms. Angela Gittens

The Subcommittee met on February 20/21 at the FAA Technical Center to review ongoing work and the FY 2003 proposed initiatives.

We note the congressional action that retained the Airports Technology Research in F&E in FY 2001 despite the Administration's initiative to include Airport Research in AIP. The FAA's FY 2002 budget proposal once again proposes to include Airport Research in AIP under the rationale that it is appropriate to have AIP fund Airports Research because this research directly supports improvement in the safe operation of airports and increases in airport capacity and efficiency. Airports research supports the development of standards and specifications in airport design, lighting and marking, and fire and rescue that are necessary to protect the \$3.3 billion annual Federal investment from AIP in the same manner as Air Traffic Research supports F&E acquisition of air traffic control equipment.

For FY 2003, the subcommittee is proposing a significant increase in Airport Technology Research from the \$7.58M in the FY 2002 request to \$16.27M in FY 2003. Although this is a large increase, it is certainly justified to support an AIP program that has recently been increased by Congress from less than \$2 billion to over \$3 billion. The \$16.27M request is only one half of one percent of the \$3.3 billion AIP budget in FY 2003. That amount seems the minimum that should be allocated to airport research.

In FY 2003 the Subcommittee particularly supports the initiatives to accelerate research to prepare for introduction of new large aircraft (NLA) such as the A380 that has received production orders and will be operating in FY 2005. Research is needed to conduct computer modeling, statistical analysis, and risk assessment to determine if these group 6 aircraft can safely operate at group 5 airports. If this can be sufficiently demonstrated, very expensive redesign of taxiways and runways could be avoided. Research is also needed in the area of fire and rescue response to address double decker NLA's with more than 600 passengers. The Subcommittee believes the FAA should seek financial support from Airbus for this research in a similar manner that Boeing helped fund the construction of the Pavement Test Center.

Of particular concern is the problem with replacement of the fire agent Aqueous Film Forming Foam (AFFF). AFFF is the principle fire fighting foam product. The major supplier of this product has stopped production because of EPA concern's on the toxicity to humans from one of the AFFF components (perfluorooctyl sulfonates). FAA has initiated plans with the Department of Defense for a joint program to develop an environmentally friendly replacement for AFFF.



This will be a significant new initiative and the FAA contribution for this research will require approximately \$1,000,000 in FY 03.

Research in wildlife control and mitigation continues to be the highest safety project. Data indicates that the number of Canada Geese has increased from 2 million in 1990, to over 6 million today, with projections increasing to 17 million by 2010. Combining this with increasing aircraft operations and increasing percentages of two engine aircraft, all points to a significant increase in risk to aircraft from wildlife strikes.

The Subcommittee also supports the continued research into visual guidance, lighting and marking, and reductions in runway incursions. This is a key area where a total systems approach and human factors input is required to evaluate new lighting technology such as LEDs and fiber optics for signs and marking, as well as advanced taxiway guidance systems.

The Subcommittee strongly supports continued operation of the National Pavement Test Facility. Good data is being obtained and continued operation is essential to develop improved pavement design and construction models and standards. In particular, the Subcommittee supports the FY 2003 request to acquire pavement test equipment that is necessary for quality control; and rapid test results.

The Subcommittee supports research into airport planning and design but believes it should focus on airside issues and not terminals and ground access areas.

In summary, the Subcommittee is pleased with the ongoing airport technology research program and fully supports significant increases in FY 2003. The type research being done in airport pavement, wildlife control, lighting and marking, and fire and rescue will not be done anywhere else if it is not done in this program.

### Software Engineering

In recognition of the pervasiveness and importance of software in FAA ATS programs, the FAA has created a Software Engineering Resource Center (SERC). This was done at least in part as a result of earlier recommendations of the ATSSC. However, as briefed to the ATSSC, the scope and focus of the SERC are much more limited than envisioned in the earlier ATSSC recommendation. (Subsequent conversations between ATSSC members and cognizant FAA personnel suggest that the ATSSC did not get a complete picture of the software R&D activities.)

Because of the continuing criticality of software in FAA ATS systems, the ATSSC will establish a small (five to six member) Software R&D working Group to review in greater detail current FAA Software R&D activities and needs, and provide an updated report and recommendation to the FAA.

### Wake Vortex R&D

Wake-vortex-based interaircraft arrival and departure spacing are a major capacity-reducing factor in airport operations. As in the past, the ATSSC believes that the FAA is giving

inadequate attention to R&D aimed at eliminating unnecessary spacing when conditions allow it to be done safely.

**Currently the funding for wake vortex R&D is part of the Aviation Weather budget line. The ATSCC believes that wake vortex R&D is an important and separate activity, and recommends that a separate Wake Vortex R&D funding line be established. (Since the meeting, it has come to the attention of the ATSCC that a substantial portion of the FY02 funds allocated for wake vortex R&D has been reallocated to support implementation of weather sensors at Juneau, AK. The ATSCC objects strongly to this transfer, both because of the importance of the wake vortex R&D and because it is inappropriate to use RE&D funds for implementing operational systems. The ATSCC recommends that these funds be restored, and that funding for the operational sensors at Juneau be obtained elsewhere – perhaps from AIP.)**

The ATSSC has established a Wake Vortex Working Group to review current wake vortex detection and prediction technologies, and develop specific recommendations for FAA R&D activities. This working group will take as a primary input the results of an already on-going wake vortex review being carried out jointly by MIT Lincoln Laboratory and Mitre/CAASD.

#### Aviation Weather Analysis and Forecasting

The ATSSC continues to be favorably impressed with this program, which is effectively using its resources to provide weather products which will contribute to aviation safety and operating efficiency. **The ATSSC recommends that increased emphasis be placed on moving products from the experimental to operational status.** An intermediate step, in which a product is available for guidance but is not yet fully certified, is viewed as useful to provide an opportunity for user feedback before the product is finalized. It is also important that the program recognizes that products will continue to evolve even after becoming operational, and provides resources for such evolution.

**The program should be funded at least at the base level, with additional resources if possible to expedite fielding of products. As in the case discussed above under Wake Vortex R&D, funds have also been transferred from the weather R&D activities to support implementation of operational weather sensors. The ATSCC believes that this transfer is also inappropriate, and urges the restoration of these funds to the R&D activities.**

#### Runway Incursion Reduction Program (RIRP)

Runway incursion reduction is one of the highest priorities within the FAA. **However, the ATSSC believes that the current “shotgun” program, centered around a BAA soliciting relevant industry ideas, is ill-considered and will result in a delay in the operational implementation of proven technologies.**

Surface surveillance and runway incursion prevention are not new problems; much R&D has been accomplished, including a BAA a number of years ago. These activities have resulted in the identification of useful technologies and procedures, including beacon-based multilateration,

ADS-B, ASDE-X, and automatic, surveillance based runway status lights. The ATSSC believes that FAA resources should be devoted to completing the development and opeval of these technologies, and their early deployment, rather than devoting resources to seeking and evaluation new ideas. Further, the emphasis should be on systems for large, complex airports. Runway incursion prevention at smaller airports is an important but less critical issue, and should be addressed at lower priority.

#### System Capacity, Planning, and Improvements

(This program was not briefed to the ATSSC due to a schedule conflict. ATSSC comments are based on the written program plan together with previous briefings.)

This is an important activity, but not appropriately categorized as R&D. It is focused on providing short-term fixes to local problems at airports using existing technologies and procedures. Contrary to its title, it is not the focal point for FAA R&D on system capacity,

The ATSSC recommends that this activity be continued at an appropriate funding level, but not as part of the RED or F&E(1) budget lines.

#### General Aviation and Vertical Flight Technology

This activity is devoted almost entirely to vertical flight issues. As in the past, the ATSSC recommends that “General Aviation” be dropped from the program title, as it give the incorrect impression that GA-related R&D is being carried out.

### **Recommendations on FAA’s 2003 R&D Investments**

#### ***Report from the Aircraft Safety Subcommittee***

Chairman: Dr. Louis Mancini

#### **General Comments**

1. There is continuing need to obtain feedback from different perspectives in industry and academia
2. Safety research must be coordinated between all the transportation modes
3. Aircraft Safety R&D is over-arching and at the very center of the FAA’s research program

#### **Program Enhancements**

##### **Cross-cut Programs**

- Subcommittee interaction, oversight, direction in critical Agency research programs
  - Terminal Area Safety -- Aircraft Safety, Air Traffic, and Airports subcommittees
  - Communication, Navigation, Surveillance -- Aircraft Safety, Air Traffic

SAS believes safety must be integrated into all areas of research.

### **Special Focus Areas**

- Risk Management/Systems Approach to Safety Oversight
  - improve data quality
  - insure industry involvement in model development
  - aim for more rapid development
- Software research should accelerate establishing standards and certification

### **Generic Focus Area**

- Results-oriented assessments
  - SAS program reviews
  - results achieved
  - cost/benefit
- Automatic review after research program has been in existence for “x” years and “y” dollars spent

### **SAS Supports**

1. Terminal Area Safety
  - includes support for LAHSO operations
2. General Aviation
  - targeted to address most critical GA accident areas
3. Nanotechnology
  - participate in other industry-wide activity and explore potential impact on standards and policy

### **Future Direction**

- Subcommittee learned about
  - ongoing NASA research program
  - industry work to develop and deploy synthetic vision technologies
- Subcommittee will
  - develop a position and recommendation about the direction of the technology
  - provide SAS position to the REDAC Chair
  - provide recommendations to AVR-1

### **SAS.com: The Bottom Line**

We are actively working within the Aircraft Safety research community and look forward to

- future research program reviews
- continued interaction with Agency executives
- adding value to the aviation industry

**Recommendations on FAA's 2003 R&D Investments**

***Report from the Security Subcommittee***

Chairman: Mr. Viggo Butler

The Aviation Security Sub-committee recommendations are based on meetings with the Aviation Security research and policy staffs February 22 at the William J. Hughes Technical Center, Aviation Security Laboratory (ASL). The program was well presented. FAA funded research has resulted in the fielding of advanced aviation security technologies in airports in the United States and abroad. Customer near and mid term requirements are being met. Partnerships, with industry, academia, as well as within the Federal Government and the international Aviation Security community, are well established, efficient, and are leading to collaborative products. The Advisory Panel briefing process has improved significantly from 2 years ago, and should be continued in its present form.

The panel discussed the four line items in the Security budget that goes to Congress: Explosives and Weapons Detection, Human factors, Aircraft Hardening and Airport Security Technology Integration. The balance of funding between the lines and the baseline level of funding for 2003 appears appropriate.

The primary concern of the advisory panel is the continuation of the apparent disconnect identified last year. The sponsor has identified the goal of beginning to implement automated explosive detection (EDS) equipment in 2009 to do 100% inspection of checked baggage. There has been no technology identified that can do this efficiently and effectively and there does not appear to be the research funding available to reach this goal. The challenges of beginning 100% checked baggage EDS screening in 2009 will be compounded by the projected growth to 1 Billion passengers per year. Chairman Butler questioned the wisdom of the 100% EDS screening approach at the expense of leaving other vectors under-addressed. His question -- Is this the best way to spend the limited aviation security budget?

A new concept, "Free Flow" was discussed. With Free Flow, the passenger does not encounter any delays due to security; he and his carryon are screened as they move through the system. Funding required to develop Free Flow is estimated at \$10 Million per year after the first year of \$3 Million. The technology to do this is not identified. The panel was concerned with the impact funding Free Flow would have on the rest of the program. Free Flow needs a better definition i.e. what are the metrics and exactly what is the problem we are trying to solve? Also, the panel would like to see a report on the use of hardened containers, should they be used for cargo and mail?

A presentation was made identifying a requirement and proposed solution for the shortage of laboratory space to certify and operationally test explosive detection equipment and integrated systems. This requirement is driven by the change in mission of the ASL. When built, the demand for multivendor certification, the operational testing of large integrated screening

systems and life cycle support of deployed systems were not anticipated. The panel was supportive of the proposal to increase testing space.

The panel is interested in receiving a classified intelligence brief the next time they meet in Washington. They would also like to be briefed on the prioritized threat as identified by the pending Advanced Technical Means of Attack Workshop. The panel wants a feel for how good aviation security must be, that is, how hard a target does aviation security need to be before the terrorists will go to a softer one.

The panel recommends that the FAA should reexamine the goal of 100% checked baggage screening beginning in 2009 and look at putting resources into neutralizing other vectors. FAA should conduct an operational evaluation of 100% baggage screening; it is projected to require the use of nonexistent technology and airport screening space. There is not enough money in the R&D budget to identify and develop the screening technology to get to 2009. The panel needs to see a concrete plan to get to 2009 before it will support the expanded strategy.

The panel thinks that current R&D funding is appropriate and should not be cut, however, the panel does not support the unconstrained budget. Several of the areas identified for unconstrained funding, i.e. Micromechanical systems (MEMS), high brightness x-ray sources and microstructure analysis should not be aggressively funded. Trace explosive detection is already a relatively low cost approach; the low cost advantages of MEMS although promising are overshadowed by the anticipated lack in specificity and anticipated 8 year to product delay. A modest level of activity in MEMS is recommended. FAA does not have the resources to move these areas and should follow the developments resulting from the major funding of others. X-ray technology appears to have inherent limitations and has been pushed about as far as it can go. Alternatives such as trace detection need to be explored for baggage. Research should go into high operational payoff areas such as reducing EDS nuisance alarms.

### **Recommendations on FAA's 2003 R&D Investments**

#### ***Report from the Human Factors Subcommittee***

Chair: Dr. Deborah Boehm-Davis

The committee met twice since the last full meeting of the REDAC: in July 2000 at Volpe in Massachusetts, and in February 2001 at NASA-Ames Research Center in California. In the meetings, the committee heard briefings on current research projects from researchers at that location. The committee also heard briefings on the overall portfolio, mechanisms for developing priorities in the research program, as well as issues, concerns, and funding levels. Finally, some time at each meeting was reserved for committee discussion of what we had heard. The committee's goal is to have a full review of current projects -- both in-house and sponsored, as well as review of planned future investments over each two-year period. This should allow the committee to evaluate the execution of the work as well as what is in the pipeline for the future.

The current portfolio under the direction of the Chief Advisor for HF includes three primary areas, in order from area of greatest investment to least:

- Air Traffic and Airway Facilities (2003: \$10,233,586)
- Flight Deck/Aircraft Maintenance (2003: \$10,182,097)
- Aeromedical (2003: \$6,377,000).

Within the first two areas (air traffic and airway facilities and flight deck/aircraft maintenance), the research falls into a number of common topics. This creates an alternate way of describing the portfolio content (in \$000).

- **Flightdeck/Maintenance/Systems Integration & Air Traffic Control/Airways Facilities (\$11,537)**
  - Human-Centered Automation (\$3,359)
  - Selection & Training (\$3,190)
  - Information Management & Display (\$3,051)
  - Human Performance Assessment (\$1,385)
- **Aeromedical (\$6,377)**
  - Medical/Toxicology/Factors of Accident Investigation (\$3,232)
  - Human Survival & Protection in Civil Aviation (\$2,057)
  - Cabin Health & Environmental Guidelines (\$587)
- **Personnel/Other Costs (\$15,306)**

A more complete description of the programs contained within each of these research areas is shown in the Appendix. The committee noted that again this year, this funding represents a “flat” investment in research. The increase requested (less than 3%) is roughly equal to the rate of inflation for this year. This is disturbing at a time when the FAA is talking about increasing throughput and maintaining or decreasing error. As it did last year, the committee finds it difficult to believe that this goal can be achieved with a lesser investment in the human factors arena. Further, personnel/other costs are increasing, leaving a smaller amount and proportion of funding for sponsored research.

More specifically, the committee members expressed concern with expenditures in the aeromedical area. Last year, the committee expressed concern about the proportion of funds being directed to this area. In this upcoming year, that percentage has increased (in fact, more than any other area supported). Although the committee recognizes the importance of the work to supporting accident investigation and litigation, the committee feels strongly that much of the work being done is an operational function, not an R&D function and that the FAA needs to find a more logical method for supporting this work.

In the area of partnerships, the committee specifically focused on the partnerships between NASA and the FAA and between Volpe and the FAA. With NASA and the FAA, the committee felt that efforts are being expended by both agencies to ensure some connectivity between their programs. However, they do not appear to be working towards a fully integrated research program, where long-term needs are specified by the FAA and studied by NASA. Further, connectivity that does exist could be improved. As just one example, at the individual NASA locations (e.g., Ames, Langley), there is no one focal individual for work in human factors. With NASA and Volpe, there appeared to be good coordination. More of Volpe’s work is specified and structured through specific input from the FAA; thus, their work appears to be responsive to the FAA’s needs.

Also during this year, the committee took a much more in-depth look at the process by which the FAA identifies its research priorities than it had in past meetings. The committee received briefings from the Chief Scientist for Human Factors, as well as a representative from the AVR Office, who discussed how requirements were developed internally. The primary direction for the human factors program comes from a number of internal “customers” (such as Certification and Flight Standards). In addition, guidance comes from Congress, Industry, the Human Factors Plan, and Expert Advice. The committee noted some coordination problems, as well as some more general issues.

First, the committee feels that the FAA is not sufficiently broad in their perspective as they develop their research priorities, both within and outside of the agency. Within the agency, issues and priorities are derived primarily from the “bottom up”, as is done within AVR and several other operational organizations. This process tends to focus on “today’s” problems, not future problems. Thus, important problems that are developing may not be addressed through this process. For example, there are issues associated with crew augmentation for ultra long-haul routes, systems engineering, noise reduction programs, and with moving out of VNAV at 10,000 feet. Outside of the agency, the committee feels there is a need for the FAA to see their work in the context of all government work in the area of aviation, not just in terms of what they accomplish with their research activities.

Second, the committee felt that there were important issues that are not being addressed in the proposed 2003 research plans. One of the most important of these areas is the trade-off between safety and capacity. For example, there is a desire to reduce separation standards in order to improve the throughput of aircraft. However, the impact of those changes on safety has not been assessed. As we enter an era where the limits on our aviation system are due to capacity, we need research to inform us about the safety decrements to be expected with increased capacity. The committee also feels that more research is needed to support informed acquisition, especially since those individuals charged with acquiring new products do not have expertise in evaluating the safety of those systems.

In this regard, the committee had specific recommendations about research issues that should be addressed by the FAA. The first is concerned with the development of certification guidelines. There are always new systems being developed. Currently, there is no mechanism for developing safety guidelines for these systems. As new systems are presented to the FAA for certification, this becomes an issue, but it is too late to begin research at this stage. Thus, the committee recommends that the FAA invest in developing measurement techniques to assess the safety associated with new on-board systems, and particularly for capacity-enhancing automated systems.

The second issue has to do with systems management and the overall assessment of safety. The agency needs to understand what makes up safety and conduct risk analyses. Currently, there are gaps between individual programs that create system-wide safety hazards. The committee recommends that the FAA develop ongoing approaches for conducting human factors risk analyses. Further, this should be done in a manner that allows for the identification of emerging issues.

The third issue concerns the trade-offs between safety and capacity. The committee feels that the agency has not sufficiently addressed the philosophical issue of whether safety or capacity is more important. The committee recommends that the agency discuss this issue explicitly and



take a stand on whether research resources should be invested in capacity growth techniques or safety-enhancing techniques.

Finally, the agency needs to recognize that the pace of technology is accelerating. Thus, it is harder for research to keep up with technological developments. The committee recommends that the FAA consider how they might alter their process for developing research priorities to address the issue of anticipating technological changes that will affect the safety of aviation.

## **Appendix**

### **Listing of Topics Funded within Each Research Area**

#### *Air Traffic Control/Airways Facilities*

##### Information Management and Display

- Computer-Human Interface Integration
- Human Factors Design Guidance
- AF Information Display and Management
- Dynamic Resectorization Information Requirements

##### Human Centered Automation

- Flight Strip Replacement
- Electronic Flight Data
- Controller Impacts from Shared Air/Ground Spacing and Separation Responsibility
- Enhanced Vision Systems
- Situational Awareness in Centralized Monitor and Control
- Controller Decision Making

##### Human Performance Assessment

- Examination of Causal Factors Related to Operational Errors
- Runway Safety Human Factors Analysis and Guidance
- Sector Team Communications
- Controller Shift Work, Work Schedules, and Fatigue
- Task Load and Performance Assessment of the Display System Replacement and Decision Support Automation
- Team Processes in Centralized Monitor and Control Systems
- Organizational Assessment
- Integrate Human Performance Modeling

##### Selection and Training

- Prototype ATS Applicant Screening System
- Develop and Validate Computerized Application Evaluation Systems
- Prototype Workforce Analysis Tool Development and Analysis

*Flight Deck/Maintenance/System Integration Human Factors*

Selection and Training

- Analyze Data from Line Observations/Laboratory Studies to Provide Guidance on Human Error Management
- Validate Guidance for Simulator Motion Requirements
- Distribute Advanced Data Analysis Methods Linking FOQA and Simulator Data
- Expand Realistic Radio Communications in Simulator Training to Include Data Link/Non-verbal Communication
- Develop Methodologies to link Performance Data to Curriculum Modification in Air Carrier Training
- Develop Web-based General Aviation Weather Training/Refresher System
- Develop and Distribute “Best Practices” Guidance for FOD

Human Performance Assessment

- Provide Expanded APMS Methodologies and Analysis Capabilities
- Develop Aviation Maintenance Proactive Safety Assessment Tool
- Provide Technical Guidance to “Land-and-Hold-Short” Operations

Human Centered Automation

- Provide Industry and FAA Expanded Guidance Addressing Training for Automated Cockpits
- Complete Certification Job Aid Version 3.0/4.0 for FAR Part 25 Flight Deck Displays
  
- Provide Technical Information on Airport Surface Maps and Vertical Profile Displays for Moving Map Displays

Information Management and Display

- Develop Flight Data Recording and Analysis Capability for Flight Simulators
- Complete Human Factors Design and Evaluation for Electronic Flight Bags, Version 3.0
- Develop and Implement Guidelines for Maintenance Error Investigating and Reporting Systems
- Determine Operational Criteria and Training Guidance for Night Vision Goggles in Rotorcraft Operations
- Define Display Location Boundaries that correspond to Eye/Head Position for General Aviation Aircraft
- Complete Initial Computational Model to Address Information Accessibility for/Head-up/Head-down Displays
- Develop Guidance Specifications for Flight Instrument Design to Counter CFIT in General Aviation

## Aeromedical

### Cabin Health and Environmental Guidelines

- Assessment of Flight Crew Health Risks During a Flying Career
- Models of Air Flow and Disease Transmission in Aircraft Cabins

### Human Survival and Protection in Civil Aviation

- Analyze the Suitability for Component Tests as an Alternative for Showing Regulatory Compliance with Crashworthiness Standard for Aircraft
- Assess Impact Protection Performance of Aircraft Seating Systems
- Develop Performance-Based Narrow and Wide Bodied Aircraft Cabin Evacuation Approval Guidelines
- Develop Aircraft Cabin Evacuation Model as a Partial Replacement for Evacuation Tests with Human Subjects
- Development of Protective Equipment Fit, Comfort, and Performance Standards
- Develop Dynamic Modeling Capabilities in Support of Cabin Safety, Protection, and Aircraft Accident Research

### Medical/Toxicology Factors of Accident Investigations

- Perform Epidemiological Assessment of Toxicology Factors from Fatal Civilian Aviation Accidents
- Develop Guidelines to Reduce In-flight Sudden/Subtle Incapacitation
- Evaluate Autopsy Data from Fatal Aviation Accidents to Determine Protective Equipment and Design Practices
- Develop Advanced Molecular Biochemical Techniques to Enhance Aviation Forensic Toxicology
- Develop Instructional Material on the Radiation (Cosmic and Visual) Environment during Air Travel
- Survey of Inflight Medical Emergencies and Defibrillator Usage on Commercial Airline Flights
- Establish an Aircraft Accident Medical Database

## **Recommendations on FAA's 2003 R&D Investments**

### ***Report from Environment & Energy Subcommittee***

Chairman: Mr. James DeLong

***“Airport planners and consultants are warning that today’s air traffic delays will worsen in the coming decade as strong air transport growth continues to outpace runway-building projects in much of the world.”***

***“It’s a situation business advocates say will drive up the price of air travel if left untreated—and one that environmentalists warn could ignite the ire of armies of airport neighbors here and abroad if governments mandate new runways or create shortcuts in environmental safeguards.”***

*Aviation Week & Space Technology*

***October 23, 2000***

Aviation environmental compatibility is a highly contentious issue for which the FAA obviously has responsibility to assure that the public interest is protected in related policy decisions. In its 1997 report, the White House Commission on Aviation Safety and Security

recommended that the “FAA should develop better quantitative models and analytic techniques to inform management decision-making.” That is certainly also an essential element of the FAA environmental compatibility role. It is similarly essential that the REDAC and the FAA properly coordinate advocacy of environmental and efficiency goals.

It is widely accepted, as noted in the 1999 White House National Science and Technology Council report, “National Research and Development Plan for Aviation Safety, Security, Efficiency and Environmental Compatibility,” that “understanding the effects of aviation on the environment and developing technology for reducing noise and emissions are essential to sustaining aviation’s vitality.” This is a direct response to a concern that “environmental issues are likely to impose the fundamental limitation on air transportation growth in the 21<sup>st</sup> century,” which was stated, among other places, in the 1995 NSTC report, “Goals for a National Partnership in Aeronautics Research and Technology.”

Although others generally have the responsibility to develop necessary technology for mitigating aviation’s environmental impacts, the FAA has a central, leading role in “understanding the effects of aviation on the environment.” That results from Congress assigning responsibility to the FAA for aircraft noise regulation. Similar responsibility for aircraft engine emissions regulations is assigned to the EPA under the Clean Air Act, but the FAA has practical responsibility for that areas as well because it represents the U.S. at the ICAO Committee on Aviation Environmental Protection (CAEP), where standards have most recently been developed. The FAA also has responsibility for certifying compliance with both noise and emissions standards.

A related time critical matter that requires FAA environmental assessment methodologies is consideration of the recent reduction in NASA’s Aeronautics Program. The National Research Council’s Aeronautics and Space Engineering Board is currently considering that situation while evaluating “whether existing research policies and programs are likely to foster the technological improvements needed to ensure that environmental constraints do not become a significant assessment, to be reported in June, the REDAC Subcommittee on Environment and Energy has proposed the following study:

The Subcommittee proposed that FAA budget for and manage a study by the National Research Council Transportation Research Board, an appropriately informed university, DOT Inspector General, or GAO to accomplish the following:

1. Assess the validity and timetables for prior noise and emissions technology goals established by NASA or the National Science & Technology Council and adopted by the FAA.
2. Establish what is currently being done by all interested parties (e.g., FAA, NASA, academia, aircraft and engine manufacturers, air carriers, airport authorities) to facilitate accomplishment of these goals.
3. Assess whether or not these initiatives will result in achievement of the goals in the indicated timetables.
4. If these efforts are failing to collectively achieve the goals, recommend plans that better promise success, including organizational responsibility, budgets and schedules.

Estimated Cost: \$500,000

Along with similar requirements in the current, very active CAEP work program, such tasks require authoritative assessment methodologies to understand, for example, the environmental benefits of CNS/ATM, along with advanced aircraft and engine technology.

With the ability to properly conduct such assessments, the FAA will have the necessary tools to productively participate in ICAO and other international forums, as well as lead national advocacy for development of additional technology and operational measures to further improve aviation's environmental performance. Such advocacy is likely necessary for the foreseeable future because of aviation's continuing robust growth.

However, in this era of especially tight Federal budgets, the necessary resources for these functions have apparently not been appropriated because environmental compatibility goals are not properly coordinated with the FAA's high priority NAS efficiency mission goal. Therefore, REDAC should recommend an overall better-integrated budget presentation and advocacy, as well as continuing support of the proposed budget increase for the FAA Environment and Energy Program. And besides coordination with the FAA organizations responsible for air traffic services, airports infrastructure and certification of regulatory standards, the budget presentation should also recognize NASA's responsibility to maintain national leadership in aeronautical science and technology, which includes the fundamental aspects of environmental assessment methodologies.